It simply works!

BK Mikro®
Tool and Process Monitoring

Installation Manual

BK Mikro9

Tool and Object Monitoring System
Protection against Follow-up Problems
in the Process of Production

Version 2.00

Jul. 24, 2018

General Notice

Safety guidelines

This document contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger.

DANGER

Symbol with signal word: **Danger**

Immediate danger to life and limb of personnel and others.

Non-compliance will cause death or serious (crippling) injury.

WARNING

Symbol with signal word: **Warning**

Hazardous situation to life and limb of personnel and others.

Non-compliance may cause death or serious injury.

CAUTION

Symbol with signal word: **Caution**

Potentially hazardous situation

Non-compliance may cause slight injury;
possible damage to property.

Notes on correct handling

Non-compliance may cause damage to the product and/or to parts/items in the vicinity.

Important information about the product, the handling of the product, or the part of the documentation onto which is supposed to be made especially attentive.

Environmental protection

Non-compliance may have an impact on the environment.

Intended use

WARNING

Warning:

The products of Schubert System Elektronik GmbH may only be used for the applications described in the technical documents, and only in connection with devices or components from other manufacturers which have been approved or recommended by us.

Start-up must not take place until it is established that the machine which is to accommodate this component conforms to the guideline 2006/42/EC.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Qualification of personnel

Only qualified personnel may carry out the following activities on the products: installation, commissioning, operation, maintenance.

Qualified persons in accordance with the safety guidelines are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Disclaimer of liability

We have checked the contents of this document for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Areas of use

Products of Schubert System Elektronik GmbH meet the applicable, harmonized, European standards for the respective area of applications.

Warranty

For the devices of Schubert System Elektronik GmbH, the agreements determined in the General Terms and Conditions (AGB) are valid.

Fitting conditions

The fitting conditions and safety notes in the submitted document must be adhered to when commissioning and operating the products.

Trade names and/or trademarks

All hardware and software names are trade names and/or trademarks of the respective manufacturer.

Copyright

Every user documentation is intended for the operator and the operator's personnel only. The transmission and reproduction of this document and the exploitation and communication of its contents are not allowed without express authority.

Offenders will be liable for damages.

ESD (Electrostatic discharge)

All modules and components are electrostatically sensitive.
The ESD notes are absolutely to be observed.
The adjacent symbol indicates the use of electrostatically sensitive modules.
Avoid touching electrostatically sensitive components (e.g. connector pins).
Discharge your body electrostatically before touching the device (e.g. by contacting a grounded metallic object).

EU Declaration of Conformity

The product of Schubert System Elektronik GmbH complies with EMC directive 2104/30/EU and RoHS directive 2011/65/EU.

The assessment of the requirements is based on the standards listed therein.

The EU declaration of conformity and the related documentation will be maintained in accordance with the directives at:

Schubert System Elektronik GmbH
take-off Gewerbepark 36
78579 Neuhausen ob Eck
Germany

Restriction of Hazardous Substances (RoHS) Compliance

RoHS-compliant

All products of the BK Mikro9 series are Pb-free / RoHS compliant referred to EU directive 2011/65/EU.

Standard(s) for Safety

c UL us LISTED

The BK Mikro9 series is UL listed.

UL 508 - Standard for Industrial Control Equipment C22.2. No. 142-M1987 - Standard for Process Control

Note

This BK Mikro9 Installation Manual describes the installation of the following system:

- BK Mikro9

Please read the Installation Manual before the first use, and keep it carefully for the later use.

It is written for customers with prior knowledge in PC technology and automation.

Purpose

This Installation Manual is part of the Technical Documentation of the Tool and Object Monitoring System BK Mikro9. It provides service personnel and system advisors with the information required to install, commission, operate and maintain the system.

BK Mikro9

Installation Manual

Material no. 68 36 263

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1 Characteristics

The BK Mikro9 is a control system suitable for tool as well as for object and free space monitoring applications.

The complete BK Mikro9 system comprises

- a control unit
- a sensor (scanner)
- a connection cable
- various optional accessories like wands, mounting brackets...

Principle of operation

The BK Mikro9 control unit communicates with the PLC and controls the scanner movement.

The scanner checks a specified area or an object position (tool). The wand of the scanner moves to a position and checks if the wand touches anything and sets depending on the result of the measurement an output (OK or KO).

The object position is determined by a "Teach" command. The taught object position is stored permanently in the control unit or in the PLC, depending on the BK Mikro9 control unit.

The object position or an area can also be set manually with the BK Mikro PC software or with switches.

As required, every deviation can activate an immediate machine stop. Through that are avoided consequential damages of the machine and parts.

1.1 Scanning applications

BK Mikro9 scanners can be used for scanning tools and objects in different applications.

1.1.1 Radial scanning to check the existence of a tool

- Scanning on to the side of the object/tool (radial)
- Suitable with scanners TK7A/RL, TK94A/RL, TK96A/RL

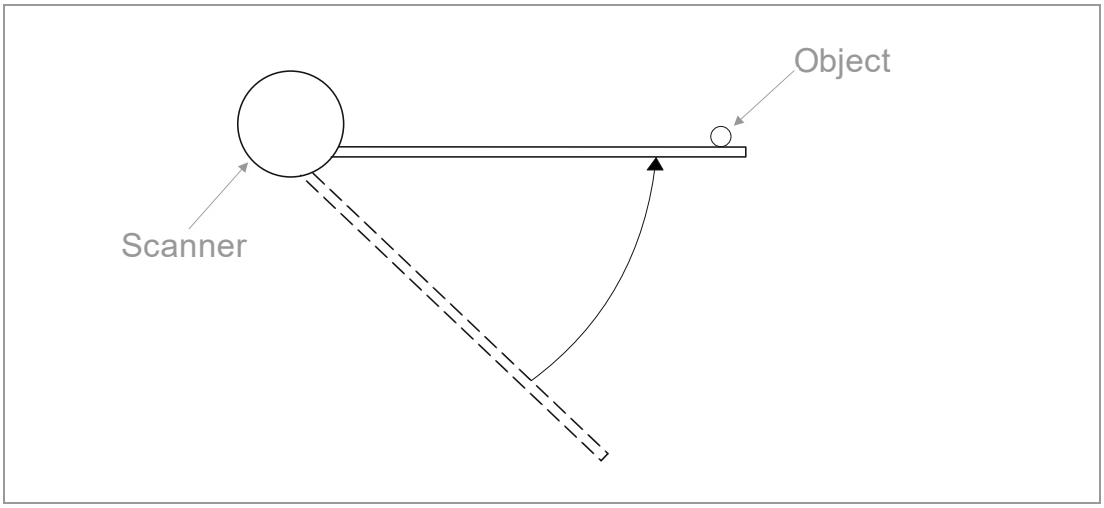


Fig. 1-1: BK Mikro9 scanning application – Side of object

1.1.2 Axial scanning to control the tool length

- Scanning on to the top of the object/tool (use scanning wand with plate)
- Suitable with scanners TK91, TK8A

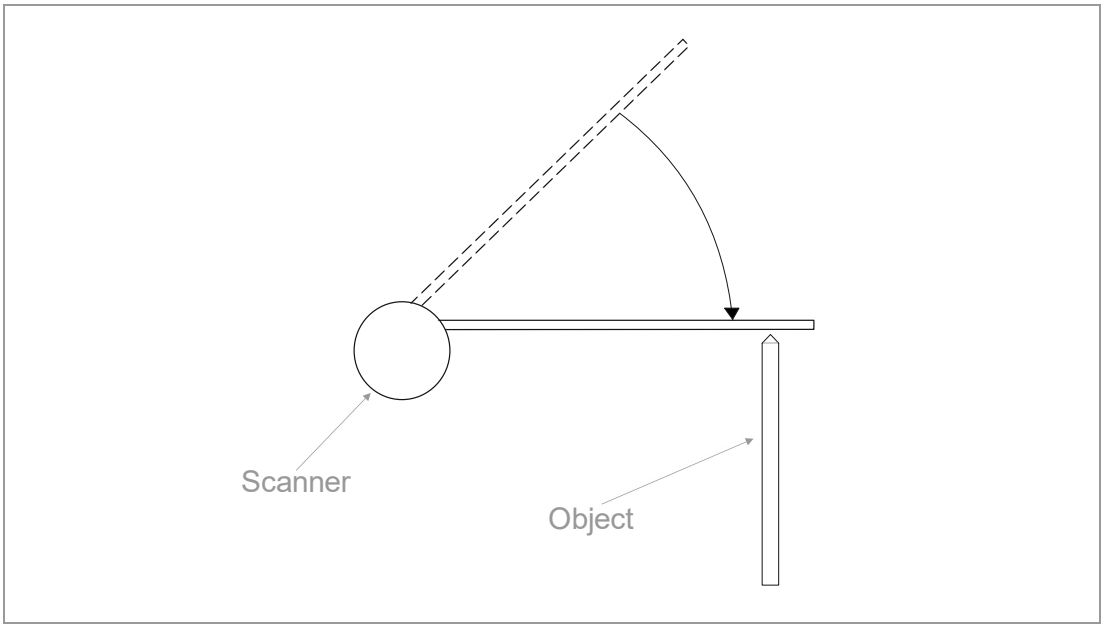


Fig. 1-2: BK Mikro9 scanning application – Top of object

1.1.3 Linear scanning

- Linear scanning
- Suitable only with scanner TK9LIN

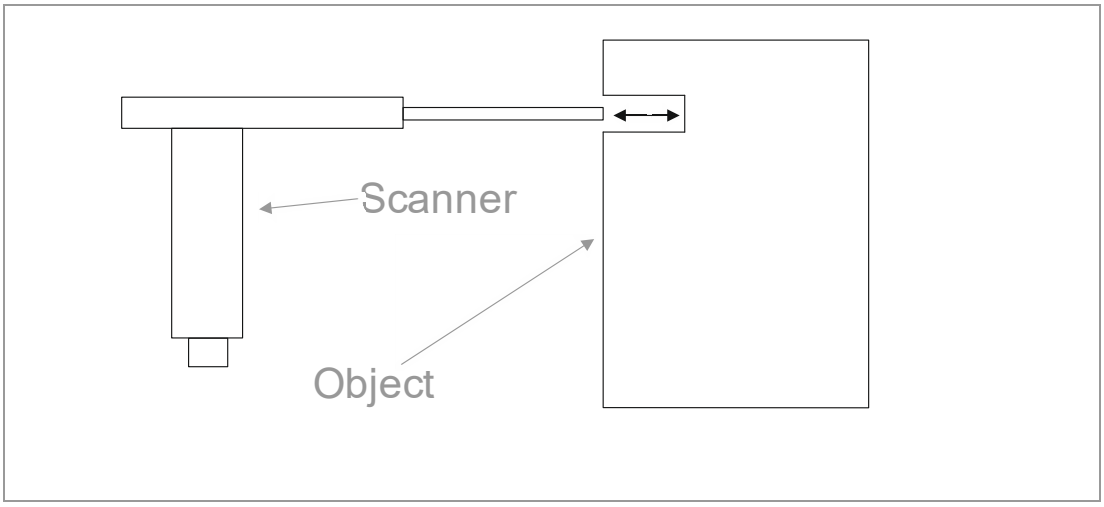


Fig. 1-3: BK Mikro9 scanning application – Linear scanning

2 System Components

2.1 Control Unit

Different versions of control units are offered:

- BKM91PB Premium – with PROFIBUS interface: all functions available
- BKM91PN Premium – with PROFINET interface: all functions available
- BKM91D Premium – with DeviceNet interface: all functions available
- BKM92 Premium – without fieldbus interface: all functions available
- BKM92 I/O Premium (including I/O module) – without fieldbus interface: all functions available
- BKM93 Basic – without fieldbus interface: reduced function range for simple handling
- BKM93 I/O Basic (including I/O module) – without fieldbus interface: reduced function range

Functionality overview

Control Unit	Fieldbus	Number of different functions / tools	Features	Reduction
BKM91PB Premium	PROFIBUS	Unlimited / 512	All	None
BKM91PN Premium	PROFINET	Unlimited / 512	All	No I/O outputs
BKM91D Premium	DeviceNet	Unlimited / 512	All	None
BKM92 Premium	–	512	All	None
BKM92 I/O Premium (including I/O module)	–	512	All	None
BKM93 Basic	–	1 / 2 only with R/L Mode	CheckObj and FreeSpace only	Intensity Return travel monitoring No area adjustments Parameter reduction
BKM93 I/O Basic (including I/O module)	–	1 / 2 only with R/L Mode	CheckObj and FreeSpace only	Intensity Return travel Outputs No area adjustments Parameter reduction

Descriptions of BKM91PB Premium, BKM91PN Premium and BKM91D Premium control units are not included in this manual (for these see BK Mikro9 Fieldbus Manual, item no. 68 36 323).

2.1.1 Characteristic properties

The BK Mikro9 system control unit is housed in a protection class II insulating housing.

On the top and bottom side, the control unit is fitted with plug-in screw terminals to connect all machine inputs, outputs and supply voltage.

The scanner will be connected via a special cable to the scanner socket of the control unit.

The BK Mikro9 control unit – build-in device for switch cabinets – is designed for supply voltage 24 VDC. Other supply voltages can damage the device.

2.1.2 Connection terminals

CAUTION

Note:

The plugs may only be inserted or removed when the power supply has been disconnected.

The blocks are keyed so that they cannot be accidentally plugged into the wrong socket.

Uncharacterized clamps must be blank.

CAUTION

Note:

The nominal tightening torque for the clamping screws of the terminal connectors should be 0.5 - 0.6 Nm or 4.4 - 5.3 pound-inches (lbf in).

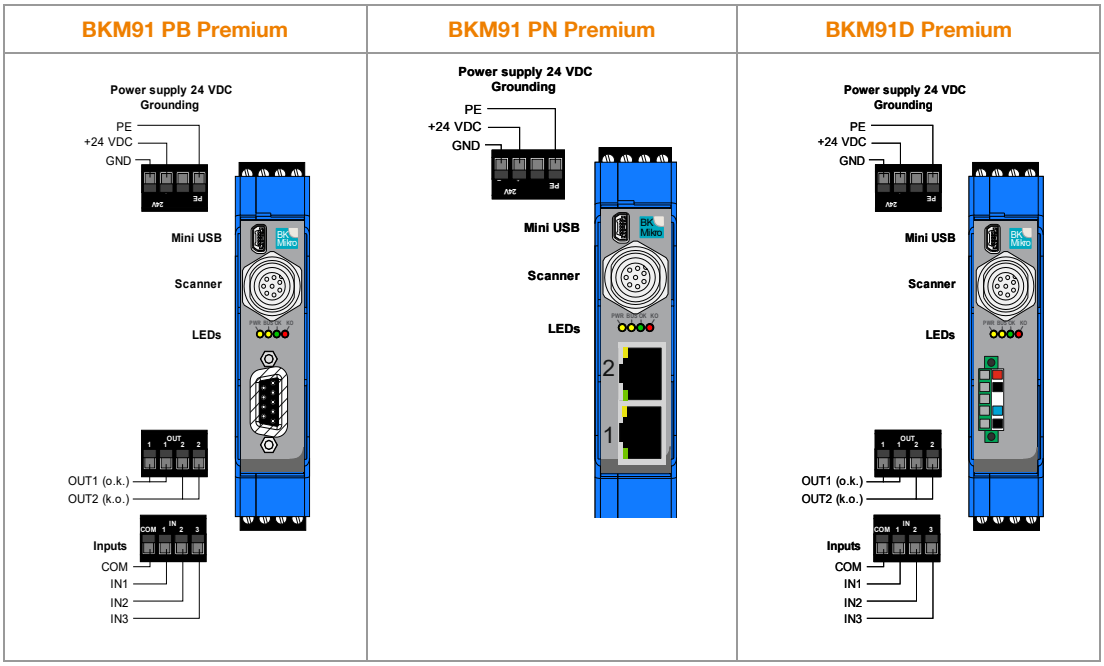


Fig. 2-1: BK Mikro9 control unit (Fieldbus Premium) – Front side with connections

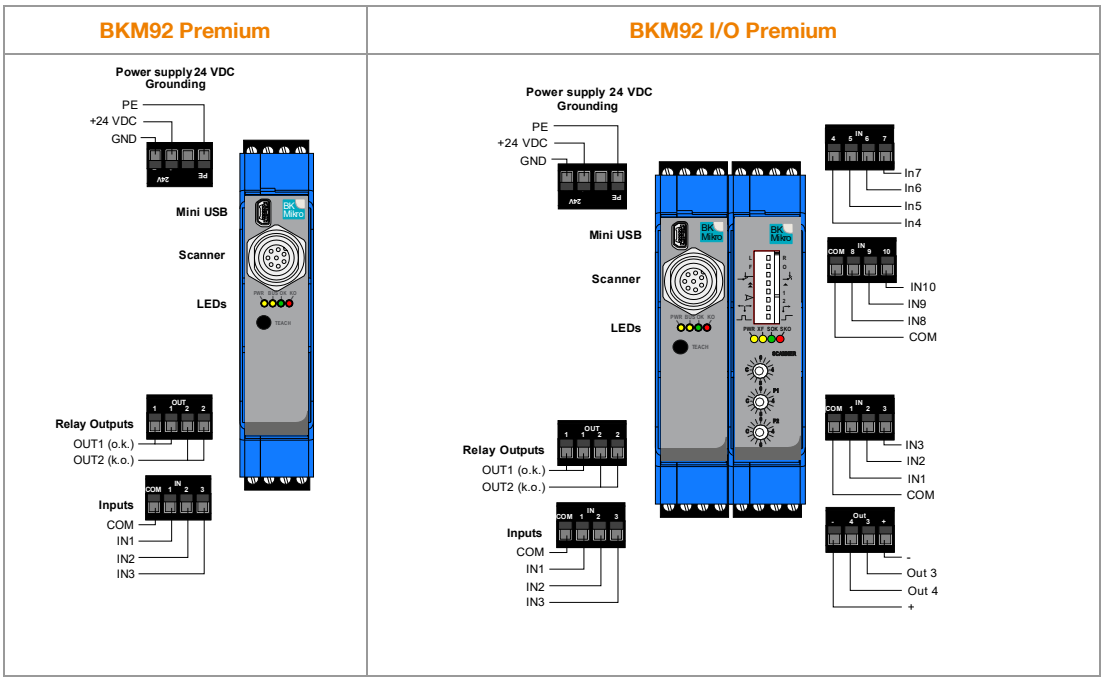


Fig. 2-2: BK Mikro9 control unit (Premium) – Front side with connections

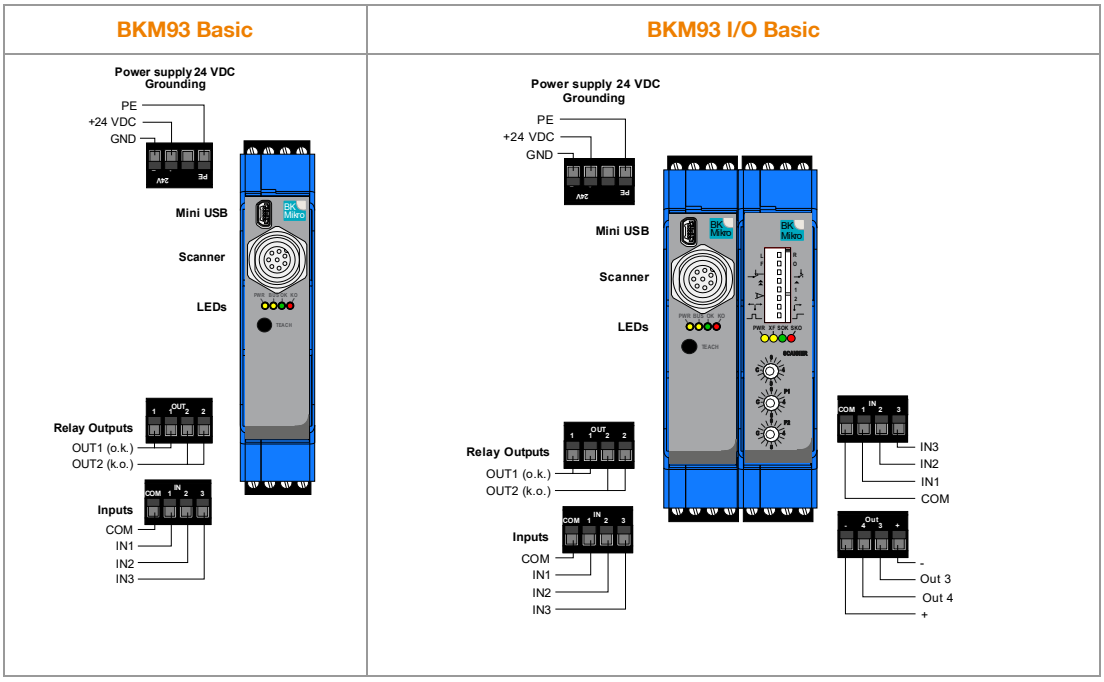


Fig. 2-3: BK Mikro9 control unit (Basic) – Front side with connections

BK Mikro9 control unit – Connection positions

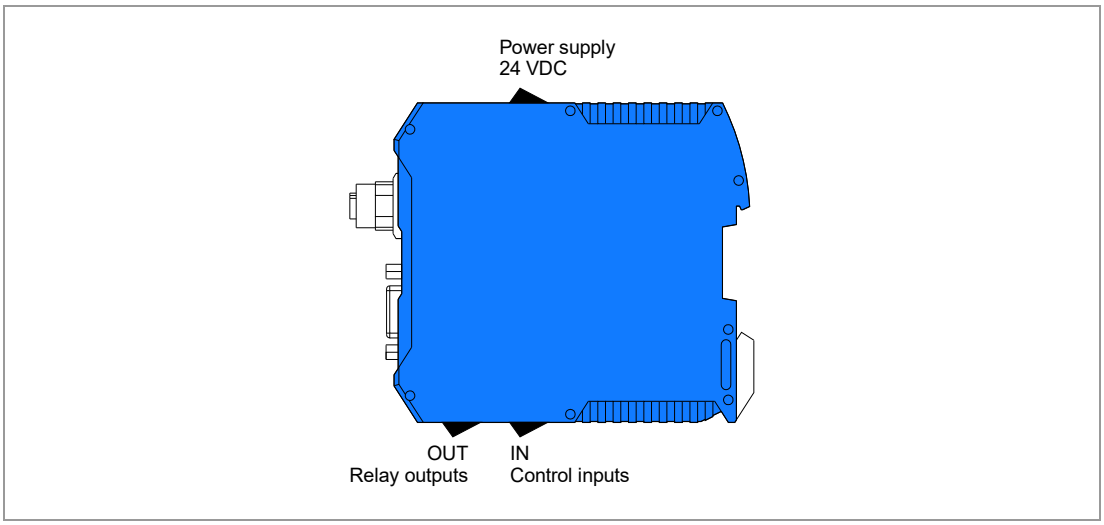
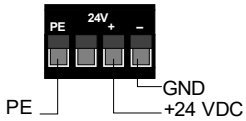


Fig. 2-4: BK Mikro9 control unit – Connection positions

24V – Power supply 24 VDC



+	**Input of 24 VDC supply voltage**
–	**Reference potential of 24 VDC supply voltage**
PE	**Connection to earth potential**

Fig. 2-5: Connection – 24V

WARNING

Mains supply voltage 24 VDC

24 VDC supply for integrated DC/DC transducer.

Warning:

Connect to a power supply of class ES1 according to EN 62368-1 (formerly SELV according to EN 60950-1).

Attend to "+" and "–" polarity!

OUT – Relay outputs

The outputs are galvanically isolated.

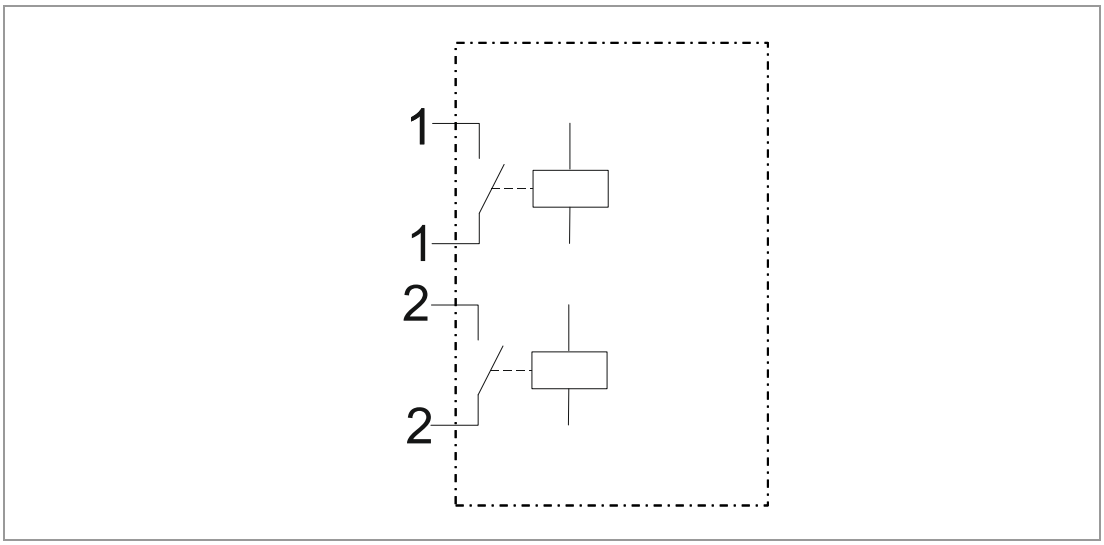
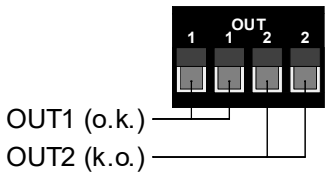


Fig. 2-6: BK Mikro9 control unit – Relay outputs



1	**Relay 1 (OK) *** Indication of a no fault message (OK) (2 terminals)
2	**Relay 2 (KO) *** Indication of a fault message (KO) (2 terminals)

* Default configuration of the control unit.

Fig. 2-7: Connection – OUT

By internal parameters, they may be configured via PC software, PROFIBUS or BK Mikro9 I/O module as either normally closed or normally open.

The contacts have been designed for 24 VDC and are protected by additional internal circuits against inductive switch-off peaks of up to 19 W (2 ms).

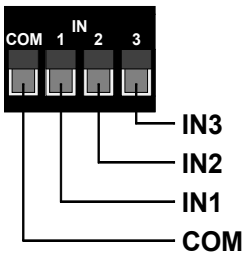
Note:

Relay as normally closed contact	NCC:	active	=	open
		inactive	=	closed
Relay as normally open contact	NOC:	active	=	closed
		inactive	=	open

When there is **no power** to the unit, the **contacts always** will be **open**.

Even when using relay as normally closed, they are open (like the active status) when the power supply is not connected.

IN – Control inputs



COM	**Reference potential for control inputs and selection input** Positive logic: GND Negative logic: 24 V
1	**"Teach" – Control input *** An input level of +24 VDC relative to "COM" terminal will trigger a "Teach". The position stored during the "Teach" will remain stored even after the unit has been switched off.
2	**"Start" – Control input** An input level of +24 VDC relative to "COM" terminal will trigger a "Start" cycle (the real scanning process).
3	**Stop – Control input *** An input level of +24 VDC relative to "COM" terminal will trigger a "Stop" (an operation will be disconnected).

* Default configuration of the control unit.

Fig. 2-8: Connection – IN

Input 1 & Input 3 can be changed in its functions via configuration software.

All inputs can be connected with positive or negative logic.

- Positive logic
  - COM input must be put on GND.
  - The particular input (IN 1 – 3) will be set to high when 24 V is applied.
  - As low-condition the input should be set to GND or left open.
- Negative logic
  - COM input must be put on 24 V.
  - The particular input (IN 1 – 3) will be set to high when 0V (GND) is applied.
  - Considered low-condition the input should be connected to 24 V or left open.

Unnecessary selection inputs may remain open.

A signal must be applied for at least 40 msec to be effective.

2.1.3 LEDs to indicate status information

Four light-emitting diodes (LEDs) on the front panel of the BK Mikro9 control board are used to indicate status information.

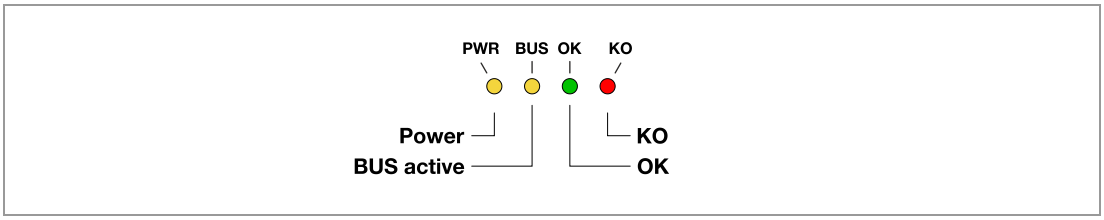


Fig. 2-9: Light-emitting diodes

LED	Color	Designation	Function	Status
PWR	Yellow	Power	Power supply 24 VDC	On
BUS	Yellow	BUS active	USB active	On
			Data transmission (USB/PROFIBUS/DeviceNet)	Flashing
			Bus not active	Out
OK	Green	OK	Scanning "OK"	On
KO	Red	KO	Scanning "KO"	On

2.1.4 Mini-USB connection

It is possible to set parameters of the BK Mikro9 control unit and to run functions manually with the "System Setup BK Mikro9" configuration program via USB interface of a PC.

After starting the configuration program, the start page will appear where various functions can be selected in the menu.

- Up to 512 functional attributes like specified object position, tolerance and backstop power can be defined in the programming operation.
- The present monitoring cycle status is displayed in detail when in manual mode.
- The wand can be operated or set manually (=>Manual Mode).
- A trace function for long-term monitoring is available (=>Trace).

A window in the manual mode shows the current PROFIBUS/PROFINET/DeviceNet message which is sent to the BK Mikro9 and the message which is sent to the PLC.

For further information please use the "Help" menu of the program.
The program is free to download at:

http://www.bkmikro.com

The connection is a commercial USB-Mini to USB-A cable.

2.2 BKM9x I/O module

The following section describes the I/O module of the control units BKM92 I/O Premium & BKM93 I/O Basic.

2.2.1 Characteristic properties

The BKM9x I/O module is used if several inputs or outputs are needed or the control unit should be configured directly without using a fieldbus or PC (USB).

The BKM9x I/O module offers 10 additional inputs, 2 digital outputs, several trigger switches and 3 rotary switches (BKM93 I/O Basic 2 additional inputs, 1 digital output).

Four LEDs are used for status/error display.

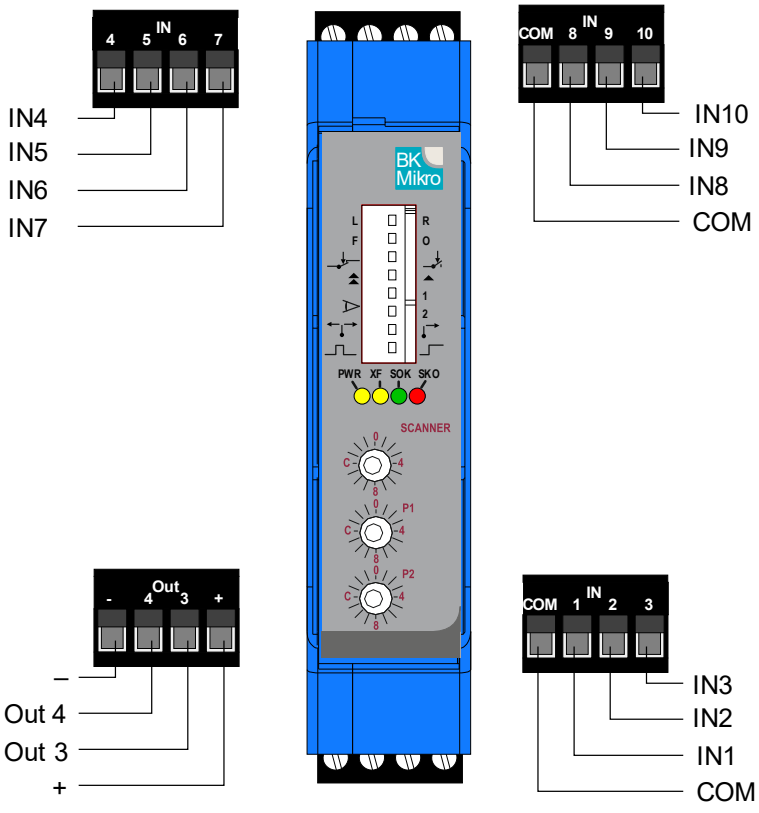


Fig. 2-10: BKM9x I/O module – Connections

CAUTION

Note:

These plugs may only be inserted or removed when the power supply has been disconnected.

CAUTION

Note:

The nominal tightening torque for the clamping screws of the terminal connectors should be 0.5 - 0.6 Nm or 4.4 - 5.3 pound-inches (lbf in).

2.2.2 Connection terminals

Control inputs

The BKM9x I/O module has a total of 10 additional digital inputs.

- 9 inputs are used for selecting the function that should be started.
- The input 10 can be used to reset the outputs of the BK Mikro9 control unit and of the BKM9x I/O module.

The function numbers selected via the inputs are from 0 to 511.

The inputs can be connected using either positive or negative logic.

- Positive logic
  - COM input must be put on GND.
  - The particular input (IN 1 – 3) will be set to high when 24 V is applied.
  - As low-condition the input should be set to GND or left open.
- Negative logic
  - COM input must be put on 24 V.
  - The particular input (IN 1 – 3) will be set to high when 0V (GND) is applied.
  - Considered low-condition the input should be connected to 24 V or left open.

Unnecessary selection inputs may remain open.

A signal must be applied for at least 40 msec to be effective.

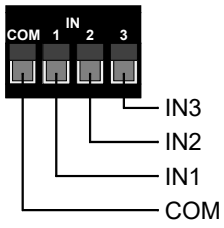
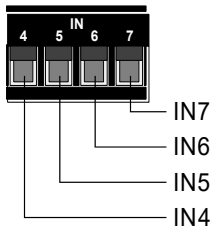
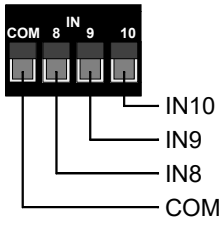
<table>
<tr><td rowspan="4"> 
</td><td>COM</td><td>Reference potential of inputs IN 1 – 7
Positive logic: GND
Negative logic: 24 V</td></tr>
<tr><td>1</td><td>Selection input 1</td></tr>
<tr><td>2</td><td>Selection input 2</td></tr>
<tr><td>3</td><td>Selection input 3</td></tr>
<tr><td rowspan="4"> 
</td><td>4</td><td>Selection input 4</td></tr>
<tr><td>5</td><td>Selection input 5</td></tr>
<tr><td>6</td><td>Selection input 6</td></tr>
<tr><td>7</td><td>Selection input 7</td></tr>
<tr><td rowspan="4"> 
</td><td>COM</td><td>Reference potential of control inputs 8 – 10
These inputs may remain open if 8 – 10 are not used.
Positive logic: GND
Negative logic: 24 V</td></tr>
<tr><td>8</td><td>Selection input 8</td></tr>
<tr><td>9</td><td>Selection input 9</td></tr>
<tr><td>10</td><td>Reset input of outputs
Outputs (e.g. OK, KO) can be reset with this input.
This input can be configured with the PC software.</td></tr>
</table>

Fig. 2-11: I/O expansion module – Connection – IN

With the 9 selection inputs 512 different tool positions can be saved and monitored.

The selection of the tool positions is done using in a binary pattern.

For example:

Tool position	Selection inputs								
	S9	S8	S7	S6	S5	S4	S3	S2	S1
0	L	L	L	L	L	L	L	L	L
23	L	L	L	L	H	L	H	H	H
176	L	H	L	H	H	L	L	L	L
511	H	H	H	H	H	H	H	H	H

L ≙ Low

H ≙ High

The BM93 I/O Basic control unit does have only selection inputs S1 and S2 for selection of the right or left tool in the **RL mode**.

S2	S1	Tool
0	0	The right and the left tool are scanned.
0	1	The right tool is scanned.
1	0	The left tool is scanned.
1	1	The left and the right tool are scanned.

At a "Teach" both tools must always be present.

Digital outputs

Two additional configurable active digital outputs are available with the BKM92 I/O Module. These outputs can be used for example to display the Home Position and can be configured with the BK Mikro PC software.

The BKM93 I/O Basic control unit does have only the counter alarm output.

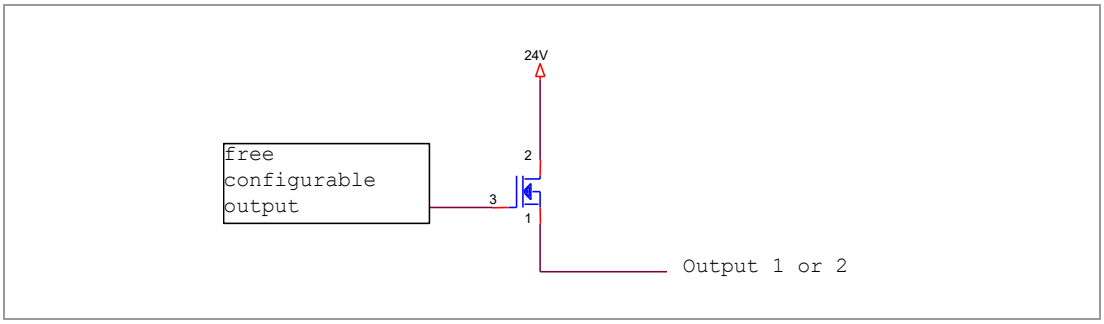
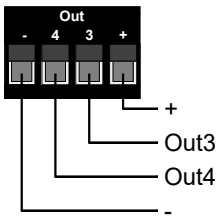


Fig. 2-12: I/O expansion module – Digital outputs

The outputs are high-side-switches, which means that, they act like switches: Either they actively switch 24V (max. 0,5 A) to the output or the output is opened.



-	**Reference potential of the outputs (GND)**
4	**Output 4**
3	**Output 3**
+	**24V power supply**

Fig. 2-13: I/O expansion module – Connection – OUT

2.2.3 Light-emitting diodes (LEDs)

Four LEDs on the front panel provide information about the current status of the expansion module BK Mikro9:

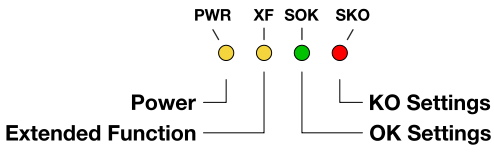


Fig. 2-14: I/O expansion module – Light-emitting diodes

LED	Color	Designation	Function	Status
PWR	Yellow	Power	Power supply 24 VDC	On
XF	Yellow	Future use	–	Off
SOK	Green	OK settings	Signal for proper switch settings	On
SKO	Red	KO settings	Signal for wrong switch settings	On

2.2.4 Configuration with BKM9x I/O module

Rotary switches

The "SCANNER" rotary switch is used for selecting the scanner. A selection between 1 and 10 can be made. Position 15 is reserved for automatic scanner detection.

If the scanner switch is not set to "0" the rotary switches P1 and P2 are used to set manually the area that is going to be checked for an object or for free space monitoring.

These switches set the position (angle) that the wand needs to travel to (P1) and how far it travels (P2) before it outputs an OK or KO signal. These switches do not need to be used if you are "teaching" the objects position (P1=0, P2=0).

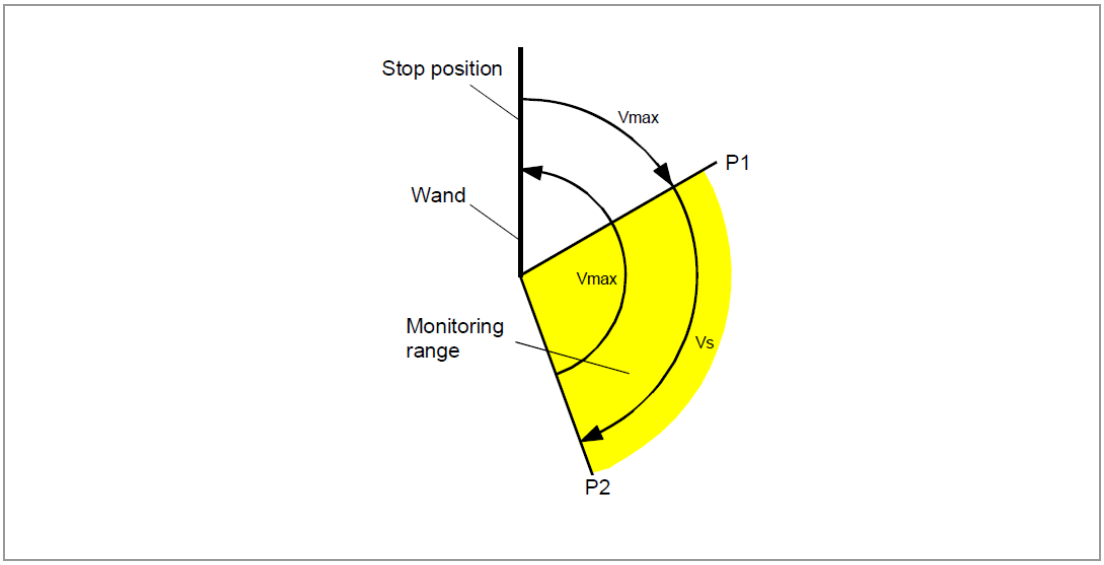


Fig. 2-15: I/O expansion module – Rotary switch P1 & P2 area

The settings are possible in steps of 24.0° (from 0.0° to 360.0°).

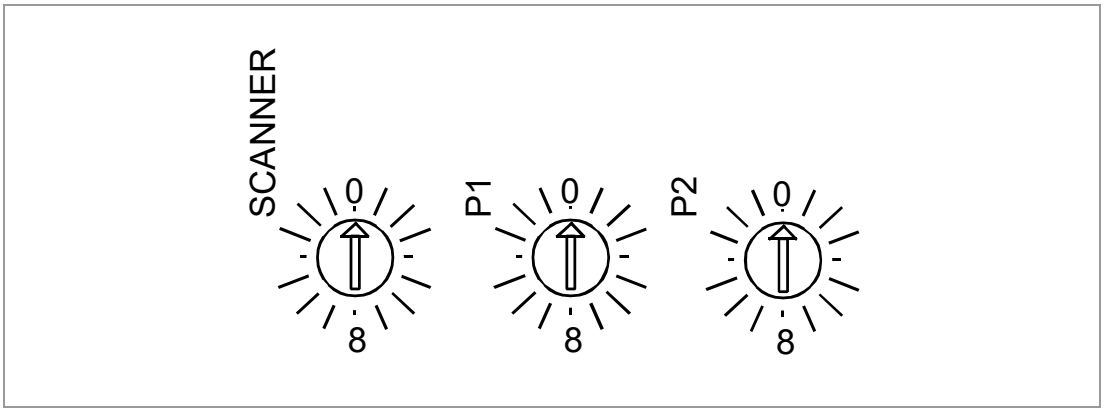


Fig. 2-16: I/O expansion module – Rotary switches

Selection of the scanners

Number	Type	Comment
0	PROFIBUS setting	P1 and P2 display the PROFIBUS address. Toggle switches are inactive.
1	TK8A	Scanner TK8: standard wand 380 mm
2	TK7A/RL	Scanner TK7: standard wand 165 mm
3	TK8A Short Wand	Scanner TK8:
4	TK91A610	Scanner TK91: optimized for wands up to 610 mm
5	TK91A510	Scanner TK91: standard wand up to 510 mm, fast movement (optimized for 510 mm wand), autodetect setting
6	TK94A/RL	Scanner TK94: standard wand 165 mm
7	TK9LIN50	Scanner TK9LIN
8	TK96A/RL	Scanner TK96: standard wand 100 mm
9	TK91A732	Scanner TK91: optimized for wands up to 732 mm
10	TK91A270	Scanner TK91: optimized for wands up to 270 mm
12	TK94A/RL250S	Scanner TK94: optimized for wands up to 250 mm
15	TK Autodetect	The scanner is recognized automatically.

Unlisted numbers are reserved for future use.

The illustration shows the factory settings.

Invalid switch settings

P1 = P2 ≠ 0 Error

cause red LED on the control unit to light.

Toggle switches

The following parameters can be set using the eight toggle switches on the front panel of the control unit.

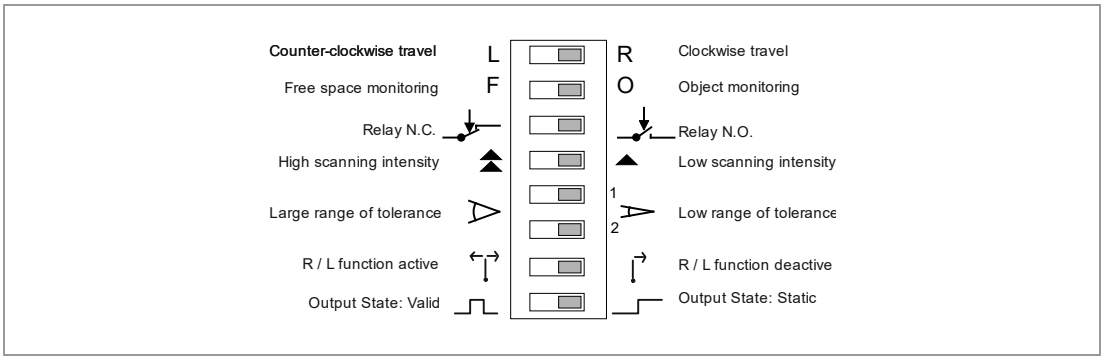


Fig. 2-17: I/O expansion module – Toggle switches

Note:

Settings at delivery: All switches are on the right side!

Only with the scanner setting unequal 0 all switches are active.
The switches have a higher priority as the saved parameters in the control unit.

Right / Left switch

Rotation direction of the scanning wand,
i.e. direction in which the wand moves from the Home Position.

R Rotation clockwise

L Rotation counter-clockwise

Rear view (of the cable connection side) on the scanning head,
in the direction of the axis of rotation

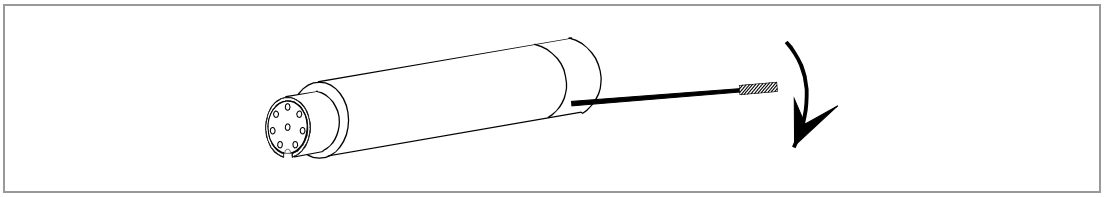


Fig. 2-18: Definition of the rotation direction

"Object / Free space monitoring" switch

O object monitoring (tool presence)

F free space monitoring (wand can move without hitting an object)

"N.C. / N.O. contact" switch

Functionality of the 4 outputs polarity:

N.O. contact are normally opened

N.C. contact are normally closed

"Scanning intensity" switch

Adjusts the speed and force of the scanning wand within the scanning range.

Switch position "Scanning Intensity"	Impact force
▲	small
▲▲	large

If this switch is in the "small" position, the reduced impact force helps to protect the wand against wear.

"Tolerance range" switch

Tolerance range for "OK" message, in relation to the target position, i.e, the position taught by a "Teach".

Switch position "Tolerance range"	Tolerance range
1-off, 2-off (small)	±0.1°
1-on, 2-off	±1.0°
1-off, 2-on	±3.0°
1-on, 2-on (large)	±10.0°

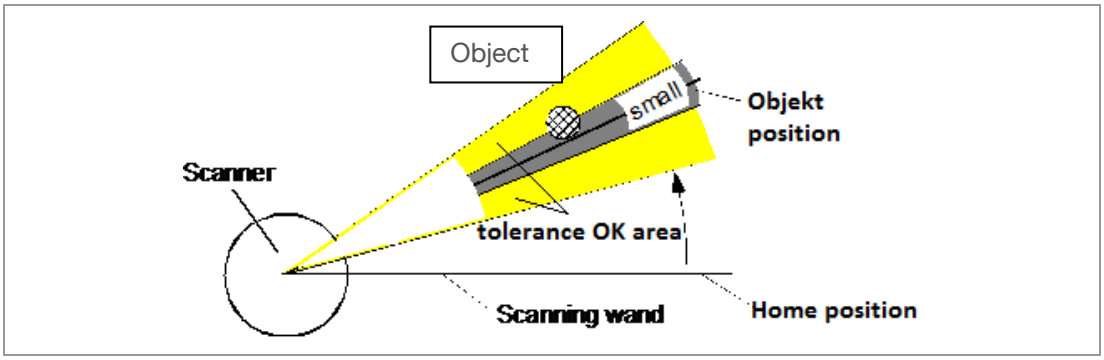


Fig. 2-19: Range of tolerance

RL function switch

R/L function inactive: The internal or an external mechanical stop is used to set the HomePos. The wand scans only in one direction.

R/L function active: The wand is between two objects (tools). The wand moves with a Teach / Start to both objects.

Output State switch

Static: The outputs are latched and stay in that state until the next "Teach" or "Start" signal is given.

Valid: The outputs are momentary or only active as long as the "Teach" or "Start" signals are held high, when the signal drops the output go to idle state.

2.3 Scanner

2.3.1 Characteristic properties

The scanner housing is cylindrical and smooth, which permits easy installation (e.g. by using the mounting bracket). The scanner is designed for easy access for servicing and changing of the wand. Aligning the scanner is easy and requires no additional instruments or aids.

The scanner listed below can be connected to each BK Mikro9 control unit.
Following chart shows the main features:

Type	Axis (∅)	Unit (∅)	Hight [mm]	Scanning wand length max. [mm]	Plate	Time of 180° rotation approx. [sec]	Repeat accuracy max. [+/– °]
TK7A/RL *	3 mm	20 mm	79 mm	250 mm	No	0.4 s	1.2
TK8A *	3 mm	20 mm	79 mm	380 mm	Yes	1.3 s	0.15
TK91A *	4 mm	32 mm	107.5 mm	910 mm	Yes	1.8 s	0.05
TK94A/RL *	4 mm	32 mm	117.5 mm	250 mm	No	0.3 s	1.2
TK96A/RL *	3 mm	12 mm	90.5 mm	100 mm	No	0.9 s	1.2
				Hub length max. [mm]		Time of 1 hub approx. [sec]	Repeat accuracy max. [+/– mm]
TK9LIN50	–	32 mm	103.5 mm	50 mm	–	1.4 s	0.05

* Type description:

A ⇒ Scanner with wand holder backstop
(no external mechanical stop for home positioning necessary)

RL ⇒ Scanner, capable of right/left run
(with external backstop or controlling of two tools simultaneously)

A customized set of the motor-parameters may be necessary for demands that differ from the denoted wand lengths or scanning times in the chart above. Please contact Schubert System Elektronik GmbH or your local distributor if the values listed above are exceeded.

The scanner can be selected with the configuration software or by using the rotary switch of the expansion module. Parameter values and technical data are listed below.

If a scanner does not match the control unit setting, the scanner type needs to be altered in the control unit before connecting. Movement can occur due to different resolution and gear ratios. This may result in maximum overstepping and damage to the scanner.

WARNING

Note:

Connecting a scanner which does not correspond to the settings of the control unit, can damage the scanner.

WARNING

Note:

Wrong scanner parameters lead to wrong measurement results.

WARNING

Note:

At scanners with an internal stop it is possible, if an angle is > 270°, that the internal stop will be travel and a wrong "OK" will be trigger.

That applies also with the TK9LIN50 scanner, if it travel in the full area (> 50 mm).

Automatic detection of the scanners

The TK9 scanner series can be detected automatically with the "TK Autodetect" parameter setting.

Note:

The TK7A/RL and TK8A scanners cannot detect automatically.

If "TK Autodetect" is active and no TK9 series scanner is connected, the TK8A scanner will be set automatically.

Note:

The TK91A is only allowed to operate with “TK Autodetect” if the scanning wand is shorter or equal 510 mm.

Longer scanning wands with this parameter setting can cause measurement errors.

2.3.2 Scanner TK7

There are two types of this scanner for different applications.

One scanner has a mechanical stop inside for scanning in one direction, the other has no mechanical stop to scan in both directions:

- TK7A – Scanner with mechanical backstop
- TK7RL – Scanner without mechanical backstop

  The TK7RL scanner can scan in one direction in special cases.

WARNING

Note:

- Due to its small diameter the wand is easily overlooked.
- The wand is a wearing part! Each contact with a rotating object will cause wear on the wand.
- For rotation tools an especially hardened HSS steel wand is available.

WARNING

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

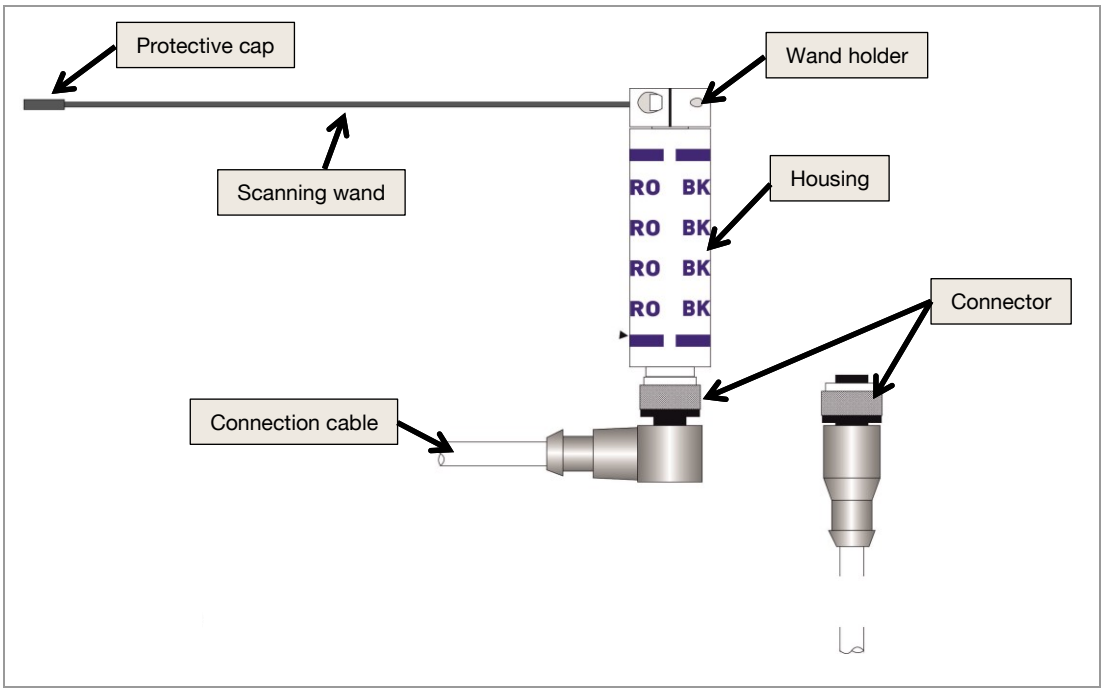


Fig. 2-20: Scanner TK7A / TK7RL

Note:

To prevent possible injury, the wand is supplied with a protective cap.

2.3.3 Scanner TK8A

The TK8A scanner has a mechanical backstop for scanning in one direction.

The TK8A scanner offers two special features:

- Scanning wands are available in lengths up to 380 mm
- Scanning plate on the scanning wand

WARNING

Note:
Wrong scanner parameters lead to incorrect measurement results.

WARNING

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

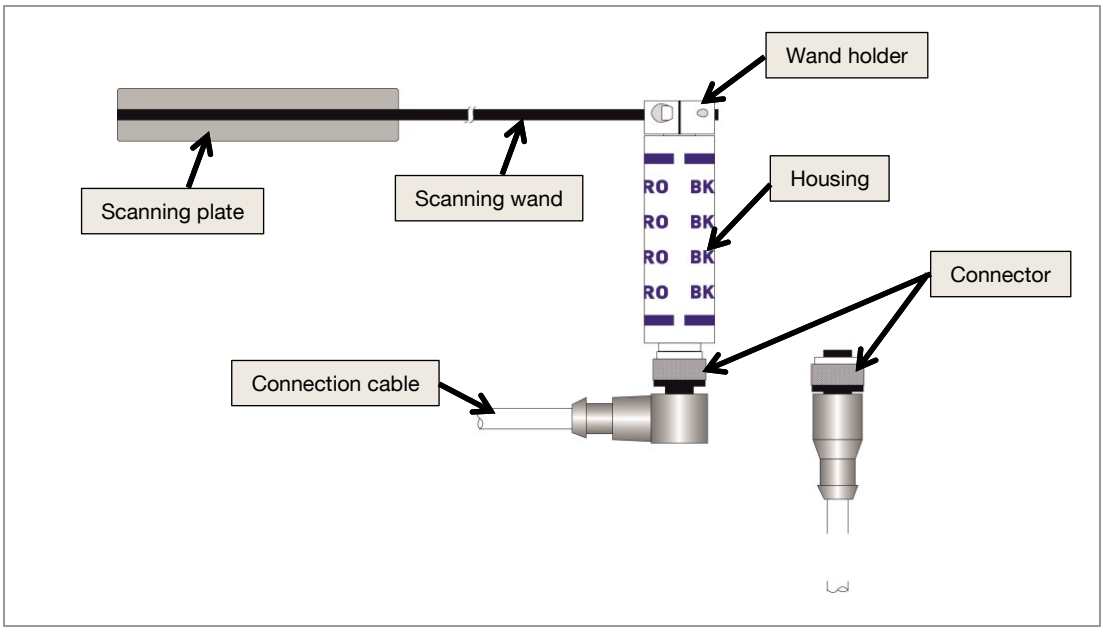


Fig. 2-21: Scanner TK8A

2.3.4 Scanner TK91

There are two types of this scanner for different applications.

The one scanner (TK91A) includes a wand holder for scanning wands without anti-twist protection.

The other scanner (TK91UNI) is without wand holder. For the TK91UNI scanner, wand holder including anti-twist protection are available.

The TK91A has a mechanical backstop that limits the rotary movement of the wand.

For the TK91UNI the internal stop is optional available with a wand holder for scanning wands with twist protection.

Scanning wands:

- Scanning wand s are available in lengths up to 910 mm
- Scanning plate on the scanning wand

WARNING

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

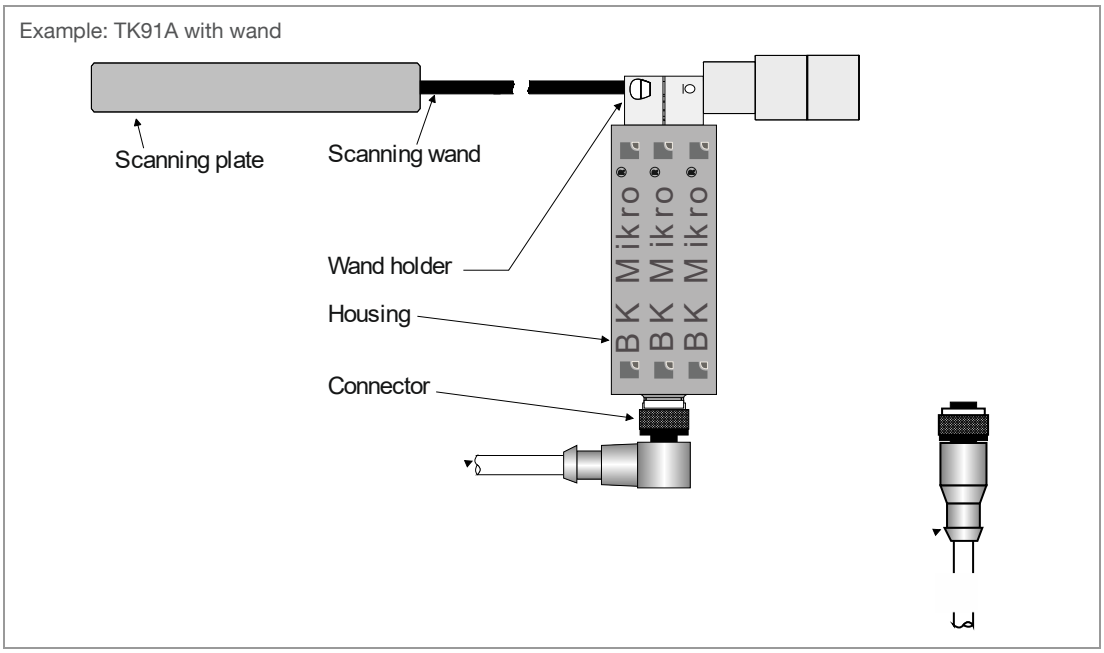


Fig. 2-22: Scanner TK91A

Note:

Information for exchanging the scanning wand follow in section "Exchanging and shortening of scanning wands for TK94x, TK7x and TK8A" of this chapter.

2.3.5 Scanner TK94A and TK94RL

There are two types of this scanner for different applications.

One scanner has a mechanical stop inside for scanning in one direction, the other has no mechanical stop to scan in both directions:

- TK94A – Scanner with mechanical backstop
- TK94RL – Scanner without mechanical backstop

  The TK94RL scanner can scan in one direction in special cases.

Note:

- Due to its small diameter the wand is easily overlooked.
- The wand is a wearing part! Each contact with a rotating object will cause wear on the wand.
- For rotation tools an especially hardened HSS steel wand is available.

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

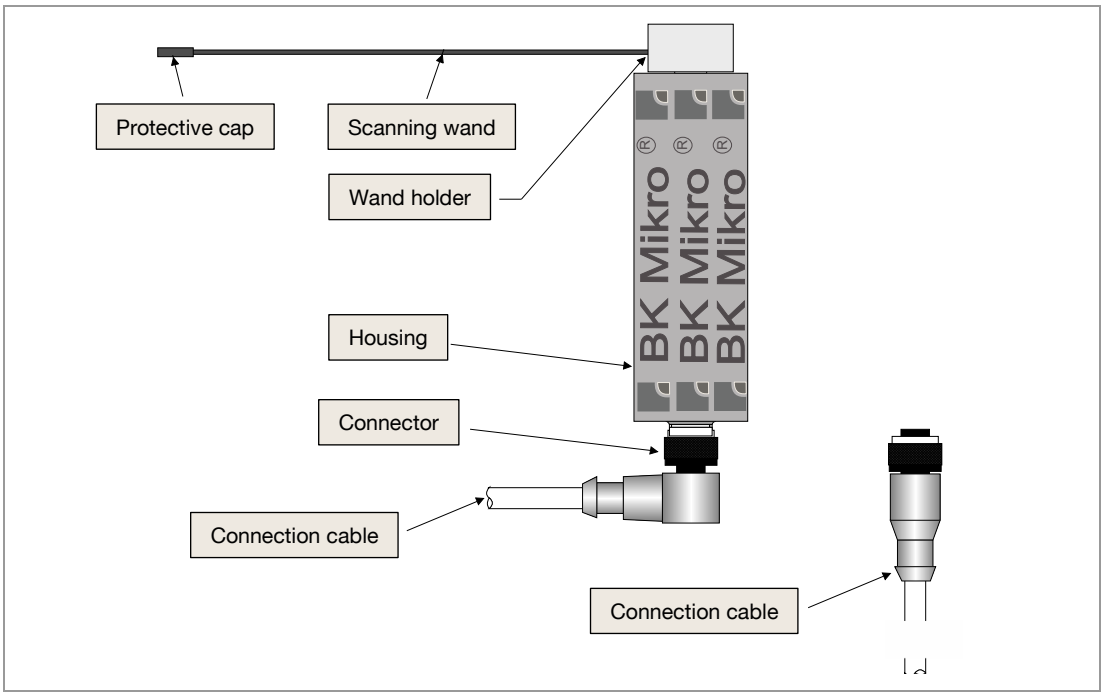


Fig. 2-23: Scanner TK94A / TK94RL

Note:

To prevent possible injury, the wand is supplied with a protective cap.

Option: Air barrier light connection

For harsh environments and aggressive emulsions or unfavorable coolant-chips combinations it is possible to run the TK94 scanner with an air barrier. The air barrier could block any emulsion that glues the wand holder to the scanner housing.

Two compressed air connections for the TK94A/RL are included and can be installed if required. There are two M5 set screws that act as plugs for the compressed air connections. You must remove the plug from the hole that you plan to install the compressed air connection into.

A pressure of 0.5 bars or 7.25 psi is recommended.

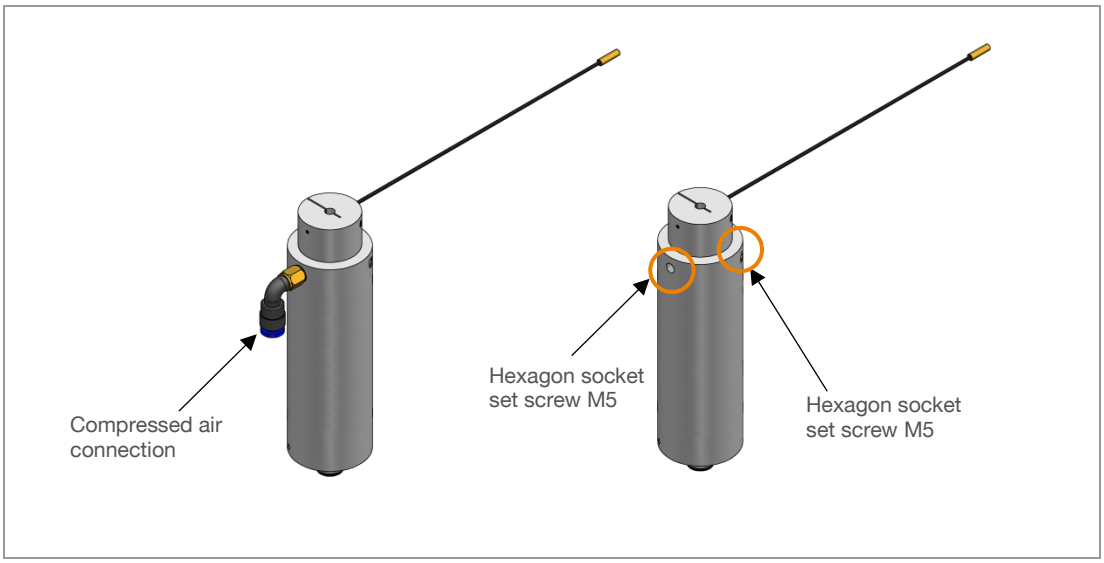


Fig. 2-24: Option: Air barrier light connection TK94A / TK94RL

For more protection for overly aggressive coolant, we recommend the air barrier adapter, see chapter "Air barrier adapter" of this chapter.

2.3.6 Scanner TK96A and TK96RL

There are two types of this scanner for different applications.

One scanner has a mechanical stop inside for scanning in one direction and the other has no mechanical stop to scan in both directions:

- TK96A – Scanner with mechanical backstop
- TK96RL – Scanner without mechanical backstop

  The TK96RL scanner can scan in one direction in special cases.

The TK96A/RL scanner has a firmly fixed cable outlet for the connection to the control unit.

WARNING

Note:

- Due to its small diameter the wand is easily overlooked.
- The wand is a wearing part! Each contact with a rotating object will cause wear on the wand.
- For rotation tools an especially hardened HSS steel wand is available.

WARNING

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

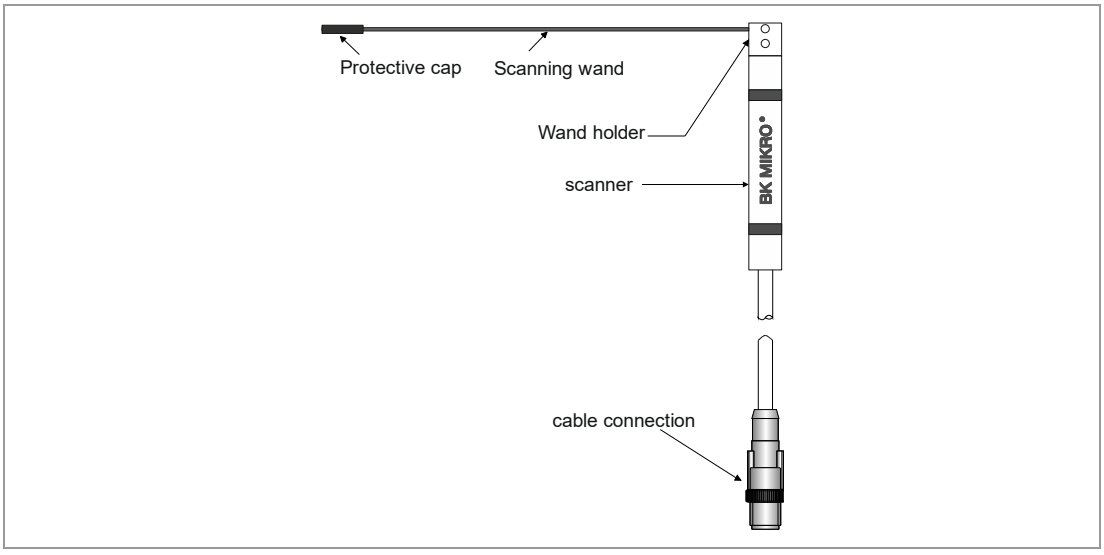


Fig. 2-25: Scanner TK96A / TK96RL

Note:

To prevent possible injury, the wand is supplied with a protective cap.

2.3.7 Mounting bracket and holding arm for TK96A/TK96RL

The scanner can be fixed and attached simply with aid of the mounting bracket. The scanner is stuck by the hexagon socket set screw into the mounting bracket and then can be fixed with the drilling.

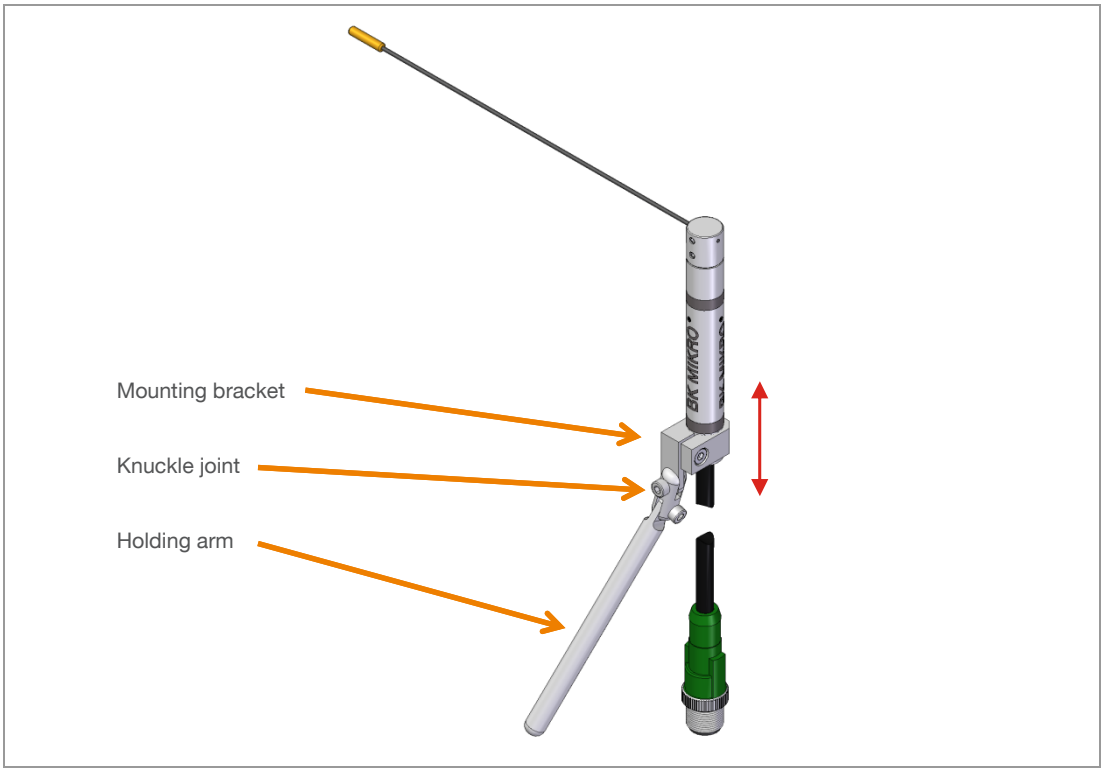


Fig. 2-26: Scanner TK96A / TK96RL with mounting bracket

Instead of fixing the mounting bracket in the machine directly, the scanner can be attached with the knuckle joint and the holding arm (see figure) to place the scanner in different positions.

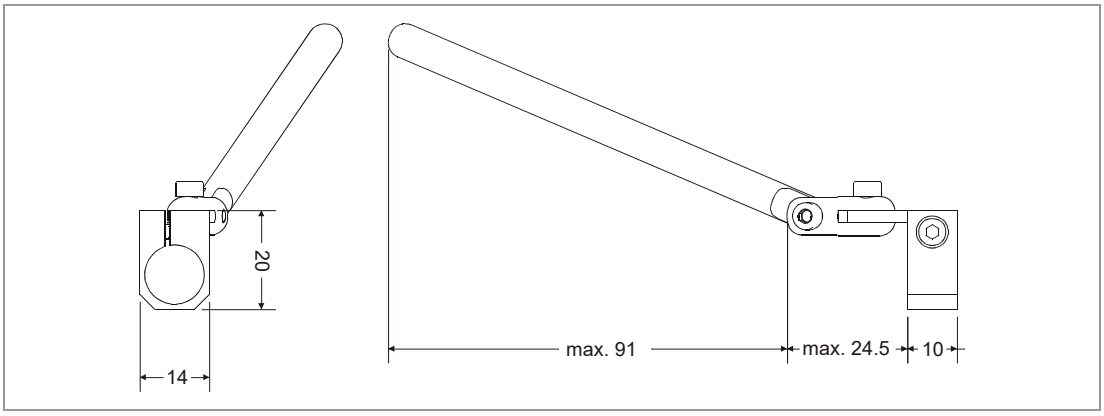


Fig. 2-27: Dimensions Mounting bracket / Holding arm

2.3.8 Scanner TK9LIN50

Where rotary scanning is unsuitable or impossible e.g. with cavities, bore holes or limited space, the scanner TK91LIN50 can be used. The TK9LIN50 does have a linear scanning wand that moves straight instead its rotary counterparts.

Any scanning range between the Home Position and the maximum stroke can be checked.

One type of scanners is available:

- TK9LIN50 with 50 mm stroke

WARNING

Note:

When using the TK9LIN scanner all positions are indicated in mm.
The mm refers to the movement of the wand, e. g. ObjectPos 23.75 mm.

WARNING

To avoid injury users should exercise caution while working in the area that the BK MIKRO wand travels.

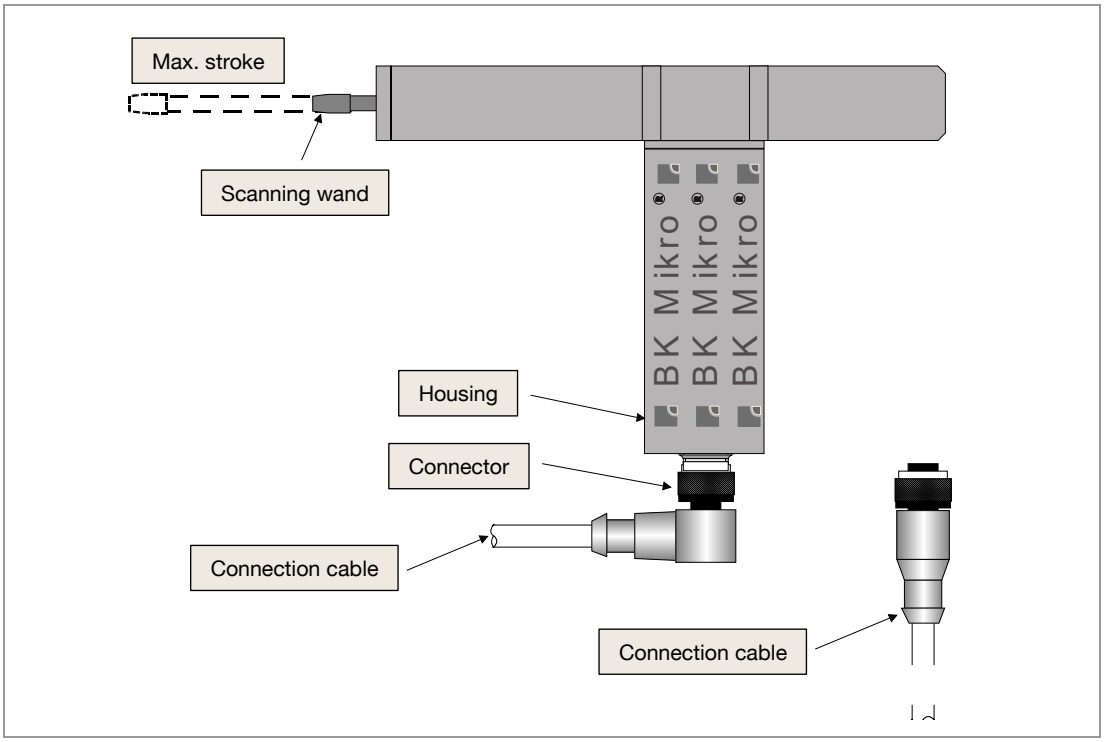


Fig. 2-28: Scanner TK9LIN50

Option: Air balance

Do not connect to compressed air!

The TK9LIN50 scanner has an optional air balance connection for airing.

It's possible for the rack and pinion area of the scanner to fill with liquids (coolants) over time. The air balance connection allows the liquid to drain out of the scanner and prevents a possible vacuum from occurring.

Two vent connections of the TK9LIN50 are included, which can be installed if required. In the two borings of the scanner, hexagon socket set screw M5 are inside as protection, one of those screws must be removed before a vent connection can be installed.

On the vent connection must be applied an air hose, whose end is open and placed at a protected place against liquids. This procedure can increase the service life of the scanner under liquids.

The open end of the hose must not connect to any compressed air.

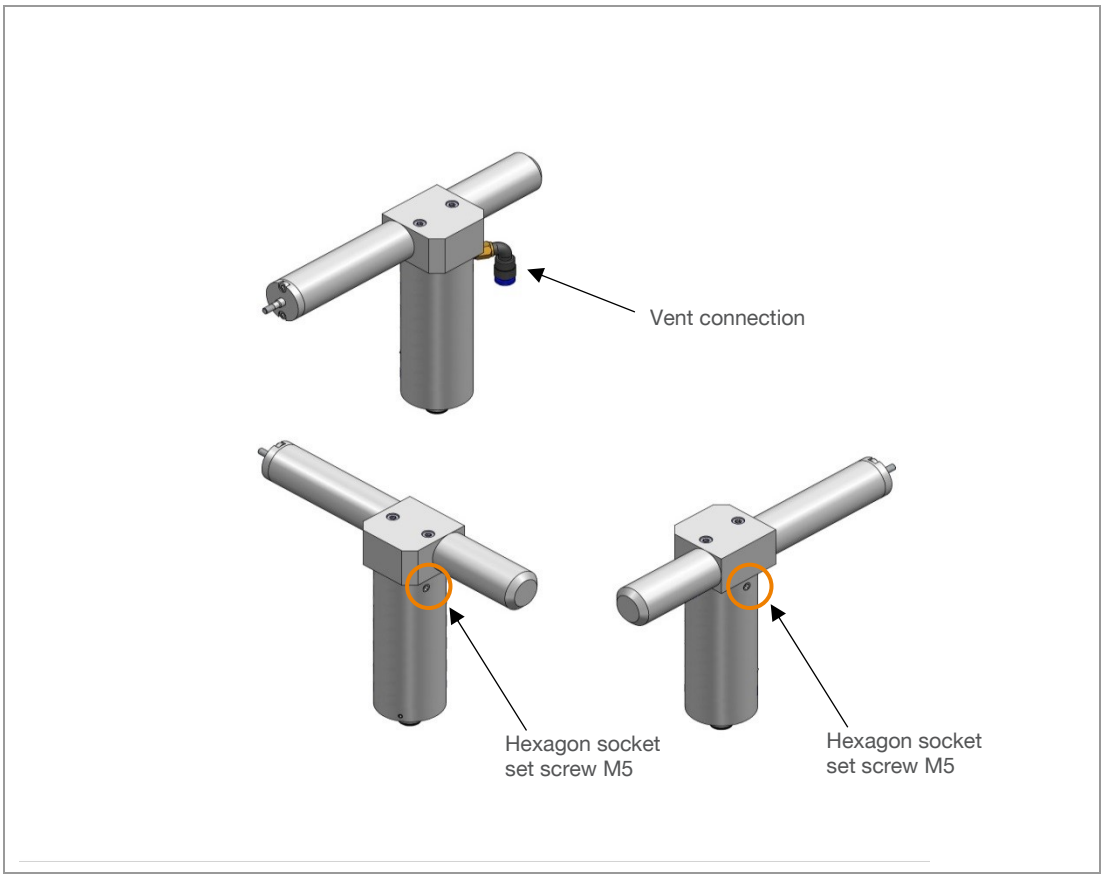


Fig. 2-29: Option: Vent connection TK9LIN50

2.4 Balance weights for TK91A & TK91UNI

A balancing weight is necessary for applications with the scanner TK91A and TK91UNI.

The more balanced the wand is, the better the scanning result (accuracy) will be. Each wand has its own designed weight for good balancing. Wands are delivered with a suitable balance weight.

For wands that are made before 2014 there can be a balance weight set installed on the scanning wand. It consists of three different small weight-parts. In this case you have to order of the weight-parts for a fine wand balance (see the following figure "Balance of the scanning wand with balance weight").

WARNING

Note:

The measuring results may vary if balancing weights are not used.

The function of the BK Mikro9 system with long wands without balance weight can't be guaranteed.

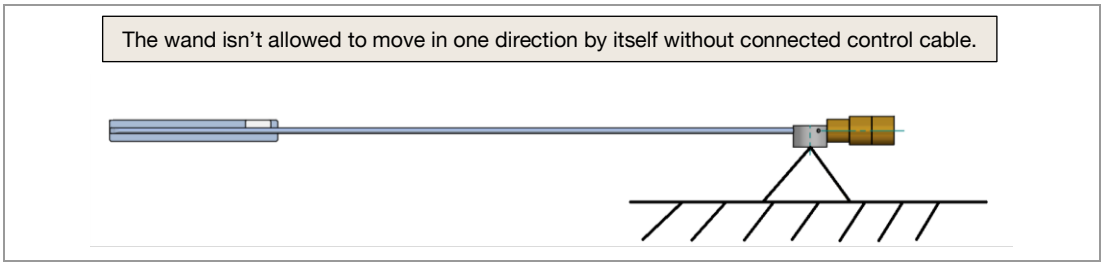


Fig. 2-30: Balance of a scanning wand with balance weight

WARNING

Note:

A wrong balance of the scanning wand can cause measurement errors!

2.5 Exchanging and shortening of scanning wands for TK94x, TK7x and TK8A

The wand can be easily removed from the wand holder by loosening the hexagon socket (M3). Insert the new wand into the wand holder and tighten.

Notes for wand exchange

- Wands with a **diameter of 1.2 mm**:

  These wands may be shortened or bent as required.

Fig. 2-31: Scanning wand with diameter 1.2 mm

- Wands of **hollow material with a diameter of 3 mm**:

  Wands may be shortened as required. Bending is not recommended.

  To prevent crushing, the wand must not be hollow in the section of the scanners positioning screw. The blind plug must be put into the end of the wand that prevents a crimped wand.

Fig. 2-32: Scanning wand with diameter 3 mm

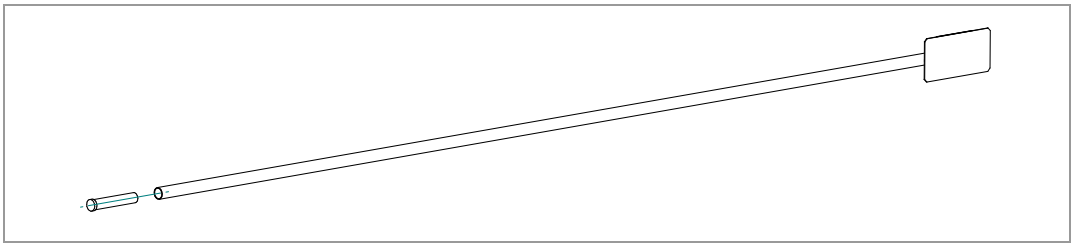


Fig. 2-33: Scanning wand with diameter 3 mm / Blind plug

CAUTION

Note:

If a hollow wand needs shortening, the provided blind plug has to be removed before cutting the wand.

After this it must be put into the open end again.

CAUTION

Note:

It is not recommended to cut scanning wands including a balance weight.

2.6 Air barrier adapter

The air barrier adapter has been mainly designed for using the BK Mikro scanner in harsh and aggressive environments.

The adapter keeps liquids and splints away from important seals with an air barrier adapter. This leads to an increased scanner life-cycle.

Note:

Some compositions of coolants or emulsions may harm the seals, if they have an unfavorable PH value.

The gear mechanism can be damaged and internal electronics may be destroyed if liquids enter the scanner housing.

Different air barrier adapters are available for select scanners and scanning wands.

Accessories and spare parts	for scanner
BKM Air barrier adapter Axis ∅= 3 mm, Wand ∅= 3 mm 	TK7A/RL TK8A
BKM Air barrier adapter Axis ∅= 3 mm, Wand ∅= 1.2 mm 	TK8A
BKM Air barrier adapter Axis ∅= 4 mm, Wand ∅= 1.2 mm or 4 mm 	TK91A TK94A/RL

Please find the installation notes in the appropriate operation manual (see item no. 68 36 266).

2.7 Connection cable

BK Mikro control cables for connection scanner and control unit are shielded twisted pair cables with 8 pole connectors.

For long distances up to 25m length two cables can be linked together.

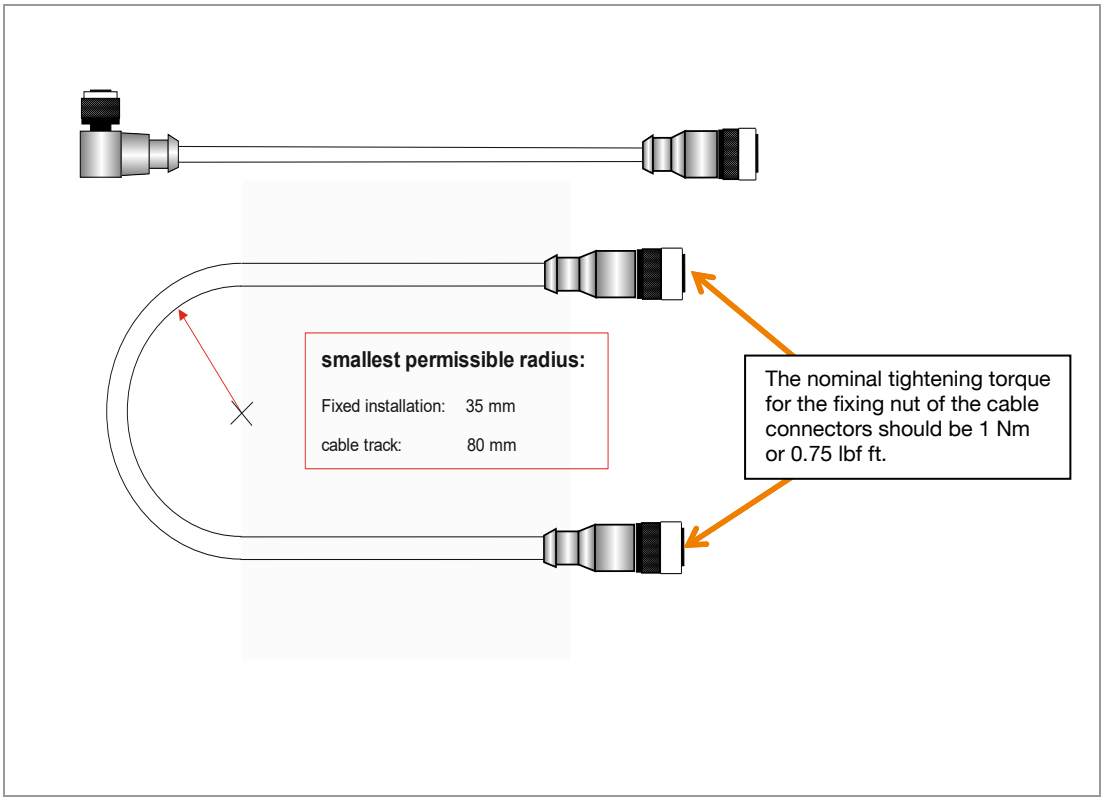


Fig. 2-34: Cable connection

CAUTION

Note:

Do not use standard 8 pole cables. BK Mikro steering cables protect the system against electromagnetic noise.

A faultless function with standard 8 pole cables can’t be guaranteed.

3 Operating Modes

There are three operating modes for the BK Mikro9 system. According to system configuration the modes are available.

- Via PROFIBUS, PROFINET or DeviceNet the system can be completely configured and operated (see BK Mikro9 Fieldbus Manual, item no. 68 36 323).
- With the "Digital I/Os" the system can be operated but only limited configuration possibilities trough the switches.
- Mini USB-connection to configure and program the system.

3.1 Operating Mode Digital I/O

Before perform a "Teach" or "Check Object" the system has to do a reference drive.

For that the system usually turns against the rotation direction and searches for a back stop.

3.1.1 "Teach" cycle

The position of a tool could be determined through a Teach-cycle. The Teach-cycle could be started though the IOs, a PC or the Teach button on the front side of the control unit. In a Teach-cycle the wand rotates until it hits on an object or tool. This position will be stored in the control unit's internal data base nonvolatile and will be taken in a Start-cycle.

To store more tool positions a tool number must be applied with the Teach-signal. The tool number needs to be selected in binary pattern (I/O inputs) when the "Teach" impulse is applied.

The default values for tolerance and scanning intensity can be adjusted using the configuration software or with the DIP switches of the control unit "BKM92 I/O Premium" or "BKM93 I/O Basic".

When the wand has not hit anything during the "Teach" cycle, it returns to the HomePos and sets the "KO" message.

3.1.2 Check Cycle

- Check Object

  In a Check (Start) cycle the wand moves to the taught position and checks if there is an object. An "OK" message will be set. If the wand stops before the monitoring range or exceeds the area a "KO" message will be set.

  The wand rotates at a higher speed and slows down to scan the monitoring range with reduced speed and strength. In the monitoring range the wand moves with a speed and force that can be influenced through the intensity.

  The tool number that should be checked needs to be selected through the binary pattern (I/O inputs), when the "start" impulse is applied.

- Free space

  The wand travels through the area that should be monitored.

  If the wand stops before or within the area a "KO" message will be set.

  The wand rotates with a higher speed and slows down to scan the area with reduced speed and strength.

  If the end of the area is reached the "OK" signal is set.

3.1.3 Switch mode = Monitoring scanning range with switch settings

The Rotary switches P1 and P2 or the software parameters P1/P2 will define the scanning range. P1 is the beginning and P2 is the end of the monitoring range.

In this mode a "Teach" is not necessary and the tolerance is not considered.

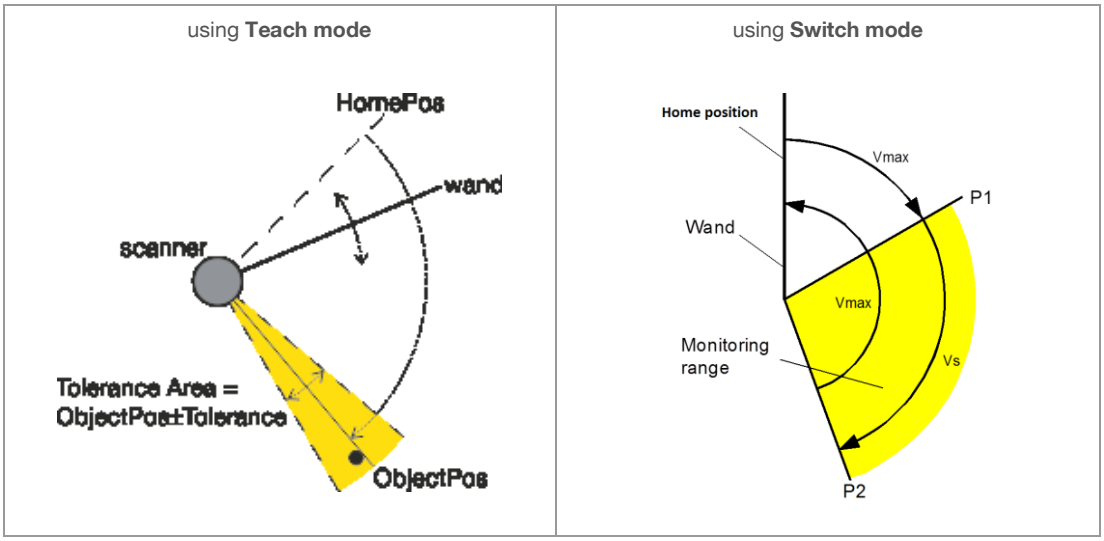


Fig. 3-1: Start cycle

Monitoring range = Range of tolerance for "OK" message

Vmax = max. speed of scanner
Vs = speed of scanner preset by "Scanning intensity" toggle switch

4 Installation Notes

4.1 Interference prevention

All inputs are opto-decoupled which provides maximum protection against interference voltage peaks that could occur from inductive sources.

Relay outputs are protected against inductive interference voltage peaks by using varistors. Further interference suppression measures may be necessary depending on the type of load used.

If suppression measures are necessary to reduce interference these measures should be placed directly at the source of the interference.

Possible additional noise filters:

- RC combination (included in the contactor suppliers' product ranges)
- Varistors
- Diodes

4.2 Wiring diagram

In the following figures are shown the schematic of the outputs, inputs and other interfaces.

Wiring diagram

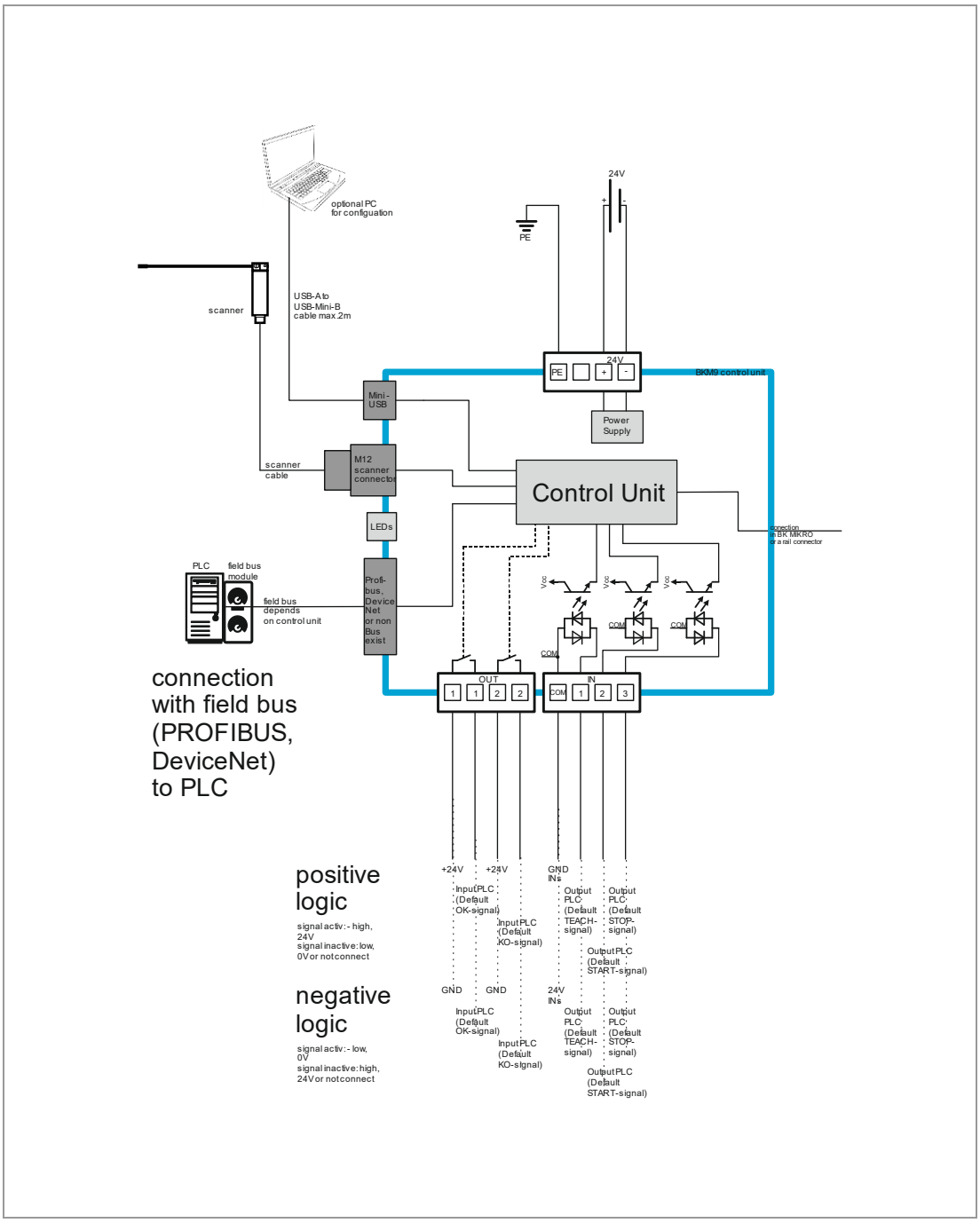


Fig. 4-1: Wiring diagram

Wiring diagram I/O unit

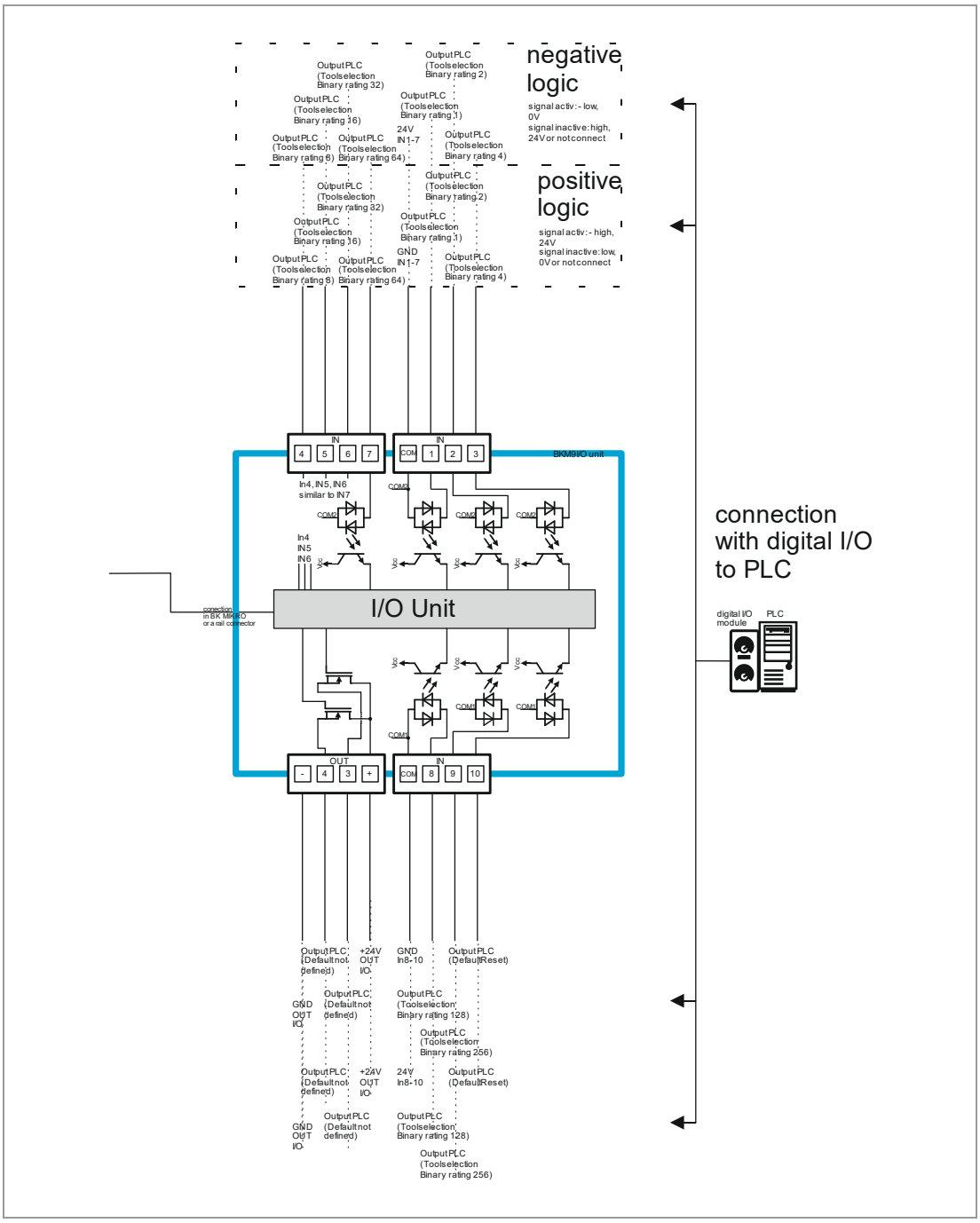


Fig. 4-2: Wiring diagram I/O unit

4.3 Timing diagram

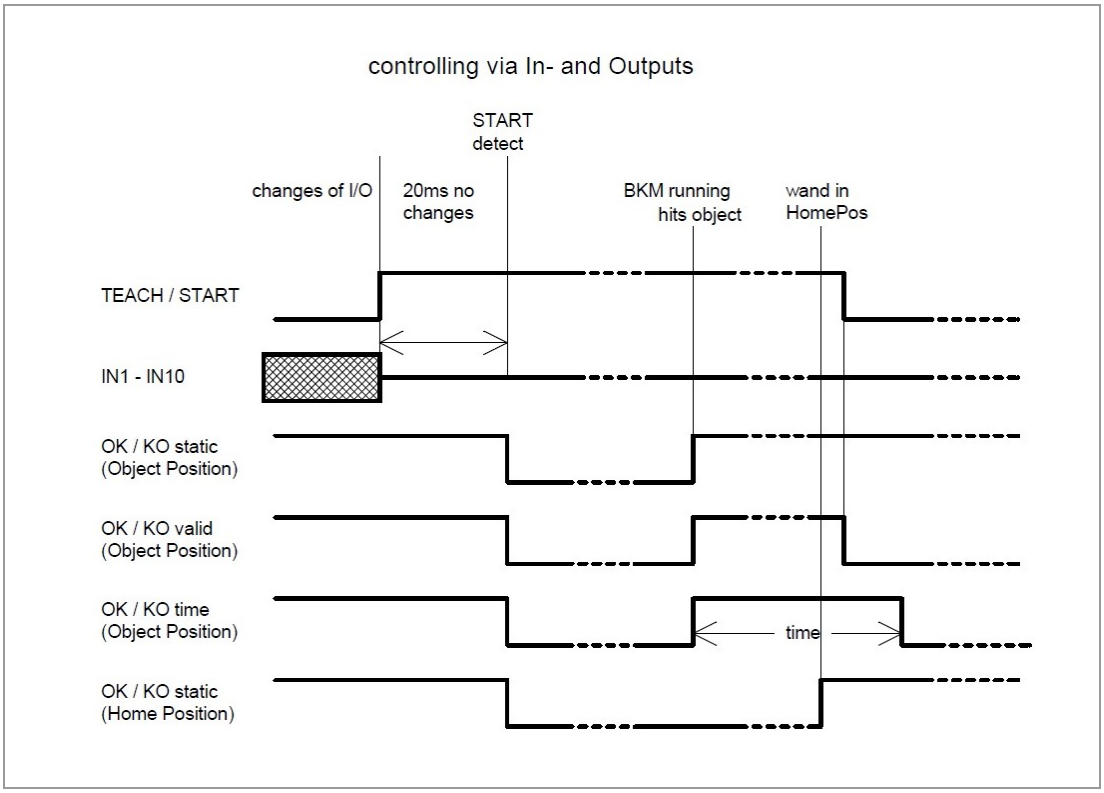


Fig. 4-3: Timing diagram

5 Configuration program for BK Mikro9

It is possible to set parameters of the BKM98 Light control unit and to run functions manually with the "System Setup BK Mikro9" configuration program via USB interface of a PC.

After starting the configuration program, the start page will appear where various functions can be selected in the menu.

- Up to 64 functional attributes like specified object position, tolerance and backstop power can be defined in the programming operation.
- The present monitoring cycle status is displayed in detail when in manual mode.
- The wand can be operated or set manually (=>Manual Mode).
- A trace function for long-term monitoring is available (=>Trace).

For further information please use the "Help" menu of the program.
The program is free to download at:

http://www.bkmikro.com

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